

Living Australian Species of the Echinoid *Pericosmus* (Spatangoida: Pericosmidae)

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Abstract

Three species of *Pericosmus* are described from Australian waters. *P. porphyrocardius* sp. nov. is described on the basis of a suite of specimens from the North-West Shelf and one specimen from north-east Queensland. The two other described species are each only known from single specimens and are placed in open nomenclature. Both were collected from waters off the Queensland coast. The phylogenetic significance of the variability of the adoral plating in *P. porphyrocardius* is discussed.

Introduction

The spatangoid echinoid *Pericosmus*, which ranges from the Paleocene to Recent, occurs quite commonly in the Oligocene-Miocene rocks of southern Australia (McNamara and Philip [in press]). Hitherto, the record of extant species of *Pericosmus* living in Australian waters was confined to a single specimen collected on the Great Barrier Reef Expedition in 1928-1929 from near Lizard Island, and described by H.L. Clark (1932) as *Pericosmus macronesicus* Koehler, 1914.

Although nine living species of *Pericosmus* have been described, *Pericosmus* is not a common heart urchin. Of these nine species, seven (*P. macronesicus*; *P. cordatus* Mortensen, 1950; *P. bidens* Mortensen, 1950; *P. tenuis* Mortensen, 1950; *P. keiensis* Mortensen, 1950; *P. mauritianus* Mortensen, 1950; and *P. oblongus* Mortensen, 1950) are each based on only three specimens or fewer. Furthermore, some of these species are based on just one juvenile specimen. Of the two remaining species, *P. melanostomus* Mortensen, 1948 is based on a number of juvenile specimens, while *P. akabanus* Mortensen, 1939 is the only species to have been described on the basis of an appreciable number of adult specimens.

Although *Pericosmus* is not a common echinoid, it is a widespread, Indo-West Pacific genus. However, ranges of individual species are restricted. The paucity of specimens of each species probably largely reflects the lack of collections made from depths at which species of *Pericosmus* are known to occur. Mortensen (1951) records the genus as generally inhabiting depths between 200 and nearly 500 m, although *P. melanostomus* is said to have been collected from water as shallow as 18 m.

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In 1982, during trawling by the CSIRO vessel *Soela* on the North-West Shelf, 16 specimens of a large, purple heart urchin were collected from about 200-230 km NNW of Port Hedland. Further trawling by F.V. *Courageous* in the same area in 1983 yielded many hundreds of specimens. Of these, 13 were collected, and measurements of axial length, width and height were made on 124 specimens which were not collected. Histograms of these data are presented (Figure 4). These specimens are herein described as a new species of *Pericosmus*. A single specimen from north-east Queensland is also placed in this species. The specimens of *Pericosmus* collected from the North-West Shelf were trawled from depths between 309 to 420 m. They were found associated with three other species of echinoids: *Lovenia gregalis* Alcock, 1893; and species of *Araeosoma* and *Stereocidaris*. This is the first record of *Stereocidaris* from Australian waters, although this latter genus has been described from Miocene rocks of southern Australia (Duncan 1877; Chapman and Cudmore 1934; Philip 1963). The discovery of *Stereocidaris* still living in Australian waters is therefore not unexpected, as it has a wide distribution today. Indeed, Fell (1966) predicted that it was liable to be discovered off the coast of Australia. At a slightly greater depth, of 720 m, *Histocidaris elegans* (Agassiz) was collected. This is the first record of the species from Western Australian waters.

Mortensen (1951: 177) was doubtful whether the specimen from the Great Barrier Reef described by Clark (1932) really was *P. macronesicus*. In the light of the description of many other species of *Pericosmus* since Clark examined the specimen, its affinities are re-assessed. The third species described in this paper is a single specimen collected by the *Nimbus* in 200 m of water off the southern Queensland coast. Although these two specimens are each considered to represent two undescribed species, open nomenclature is employed on account of the paucity of material. It is to be hoped that future collecting off eastern Australia might yield sufficient material to allow these two species to be formally named.

Measurements of specimens were carried out using a vernier calliper to an accuracy of 0.1 mm. Relative size features of the test are expressed as percentages of maximum test length (%TL). Specimens examined in this study are housed in the collections of the Western Australian Museum (WAM), Australian Museum (AM), British Museum (Natural History) (BM) and the National Museum of New Zealand (NMNZ).

Systematics

Order Spatangoida Claus, 1876

Family Pericosmidac Lambert, 1905

Genus *Pericosmus* L. Agassiz, 1847

Type Species

Micraster latus L. Agassiz, 1840: 2; by subsequent designation of de Loriol 1875: 115.

Pericosmus porphyrocardius sp. nov.

Figures 1-3

Holotype

WAM 729.83 (94.4 mm TL), a dried test trawled from foraminiferal rich mud at a depth of 410-420 m, located about 140 n. mi. NNW of Port Hedland, Western Australia (Figure 5), between 18°01'S, 118°17'E and 18°04'S, 118°12'E, at Station SO 2/82/17A of the CSIRO vessel *Soela*, on 3 April 1982; collected by L. Marsh. Water temperature at this site was not recorded, but at adjacent sites at same depth the temperature was 9.6°C.

Paratypes

WAM 730.83 (6 specimens); WAM 731.83 (1 specimen); WAM 732.83 (1 specimen); AM J17014 (1 specimen); and BM 1983.3.4.1; (1 specimen) from the same locality as the holotype; WAM 733.83 (1 specimen), trawled from mud at a depth of 316-309 m (bottom temperature 10.0°C), located about 120 n. mi. NNW of Port Hedland, between 18°22'S, 117°56'E and 18°23'S, 118°54'E at Station SO 2/82/38 of the CSIRO vessel *Soela*, on 11 April 1982; collected by L. Marsh; WAM 734.83 (4 specimens), trawled from mud at a depth of 376 m, located about 150 n. mi. NNW of Port Hedland at 17°58'S, 118°25'E at Station SO 4A/82/8D of the CSIRO vessel *Soela*, on 1 August 1982; collected by J. Fromont.

Other Material

WAM 1127-83 (4 specimens) trawled from 374-377 m, 17°59'S, 118°26'E at Station 40 of F.V. *Endeavour*, 24 August 1983; WAM 1128-83 (6 specimens preserved in alcohol) from the same locality as WAM 1127-83; WAM 1129-83 (1 specimen) trawled from 327-328 m, 18°04'S, 118°22'E at Station 38 of F.V. *Endeavour*, 24 August 1983; WAM 1130-83 (2 specimens) trawled from 351-353 m, 18°01'S, 118°25'E at Station 39 of F.V. *Endeavour*, 24 August 1983. AM J14462; trawled from a depth of 400-420 m, ENE of Raine Island, Queensland at 11°35'S, 144°04'E.

Diagnosis

Test broader than long; low. Anterior notch deep and wide. Peristome quite deeply sunken. Periproct large.

Description

Test cordate; purple; large, maximum length of type series varying between 86.1 mm and 105.9 mm; wider than long, width varying (Figure 4) between 108-121% of axial length (n = 124); maximum width anterior of position of apical system, about one-third TL from anterior ambitus; relatively low, but variable (Figure 4) (47-63% axial length [n = 121]), apex situated anterior of apical system. Anterior notch deep and wide (Figure 1A). Posterior of test transversely truncated or slightly acuminate. Apical system situated anterior of centre, 36-43% TL from anterior ambitus; slightly sunken. Ambulacrum III not sunken adapically; abapically deepens appreciably; pore pairs minute and aligned nearly exsagittally. Anterior paired petals shallow, narrow and long, 36-42% TL; diverge at about 120°; each row possesses about 40 pore pairs; outer pores of each row elongate, inner pores circular; not conjugate. Posterior paired petals shallow, narrow and shorter than anterior pair; 30-34% TL; diverge at about 75°; each row

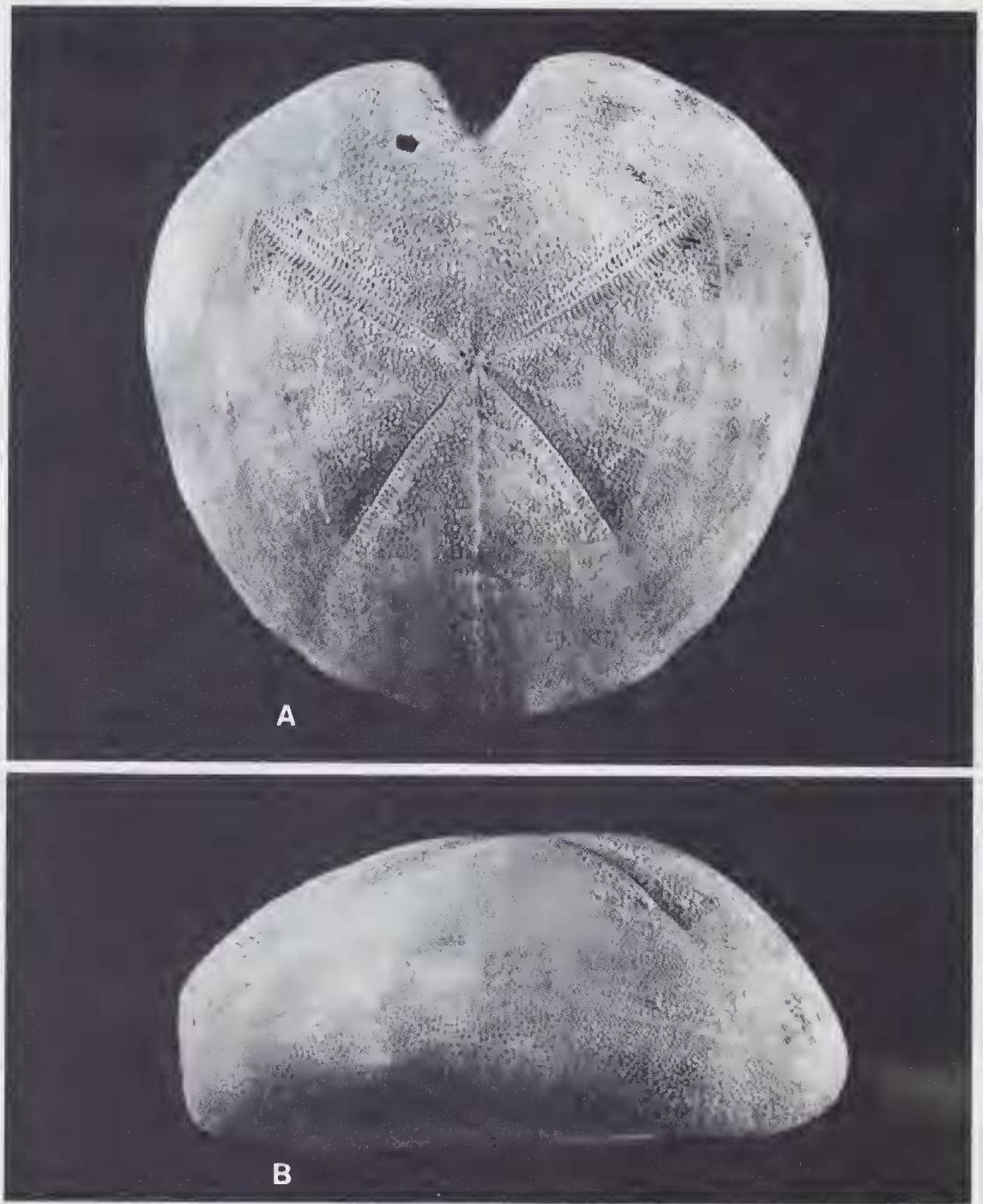


Figure 1 *Pericosmus porphyrocardius* sp. nov., WAM 729.83, holotype from NNW of Port Hedland, between 18°01'S, 118°17'E and 18°04'S, 118°12'E. (A) aboral view; (B) lateral view; both x 1.

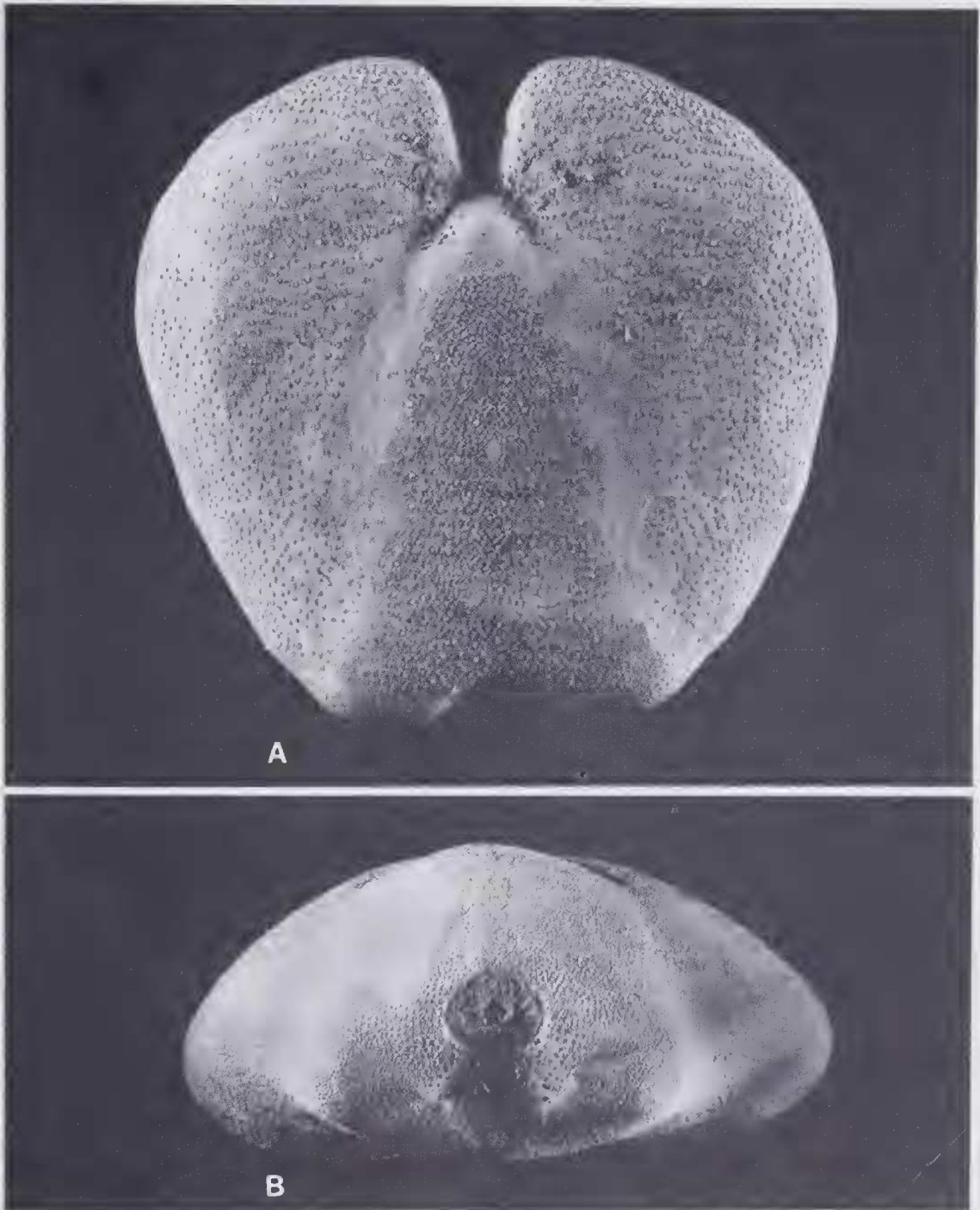


Figure 2 *Pericosmus porphyrocardius* sp. nov., WAM 729.83, holotype from NNW of Port Hedland, between 18°01'S, 118°17'E and 18°04'S, 118°12'E. (A) adoral view; (B) posterior view; both x 1.

possesses about 33 pore pairs. Peripetalous fasciole transverse between posterior petals and runs almost exsagittally between posterior and anterior petals, passing across plate 8 of interambulacra 1a and 4b; may branch in interambulacra 2 and 3, one branch extending almost transversely towards ambulacrum III, before disappearing; main branch turning through a right angle to run exsagittally through two interambulacral plates before crossing ambulacrum III; in some specimens the fasciole may be discontinuous anteriorly. Marginal fasciole runs slightly above ambitus (Figure 1B), crossing plate 4 of interambulacra 1 to 4.

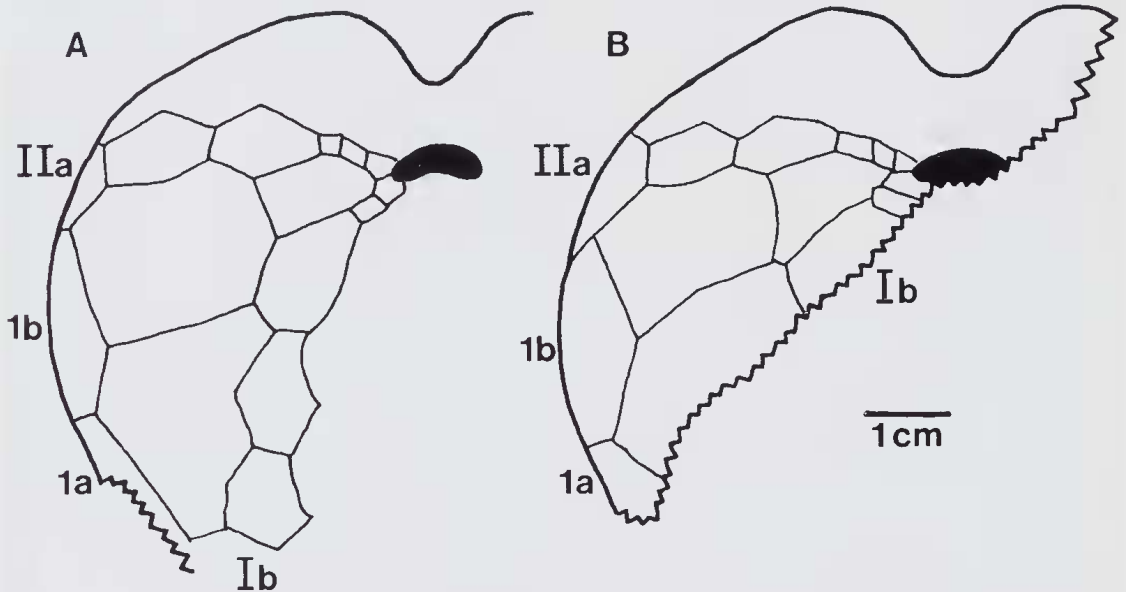


Figure 3 Adoral plating of ambulacrum I and interambulacrum 1 in *Pericosmus porphyrocardius*. In (A), WAM 731.83, the second plate of 1b bisects the plates of 1a to abutt ambulacrum I. In (B), WAM 732.83, the second plate of 1b fails to bisect the plates of 1a.

Adoral surface nearly flat. Peristome lunate, quite deeply sunken; width 11-14% TL. Labrum projects slightly anteriorly (Figure 2A). Plastron narrow, width 26-33% TL. Second plate of interambulacrum 1b greatly enlarged and generally bisects first and second plates of interambulacrum 1a, thus abutting both ambulacra I and II (Figure 3A). Extent of enlargement is variable. In one specimen (WAM 732.83) the second plate of interambulacrum 1b fails to bisect the plates of interambulacrum 1a (Figure 3B). Adoral plates of ambulacrum I are enlarged to varying degrees, particularly plates 3 and 4 of ambulacrum Ib. Periproct sunken (Figure 2B); generally circular, though in some specimens it is longer than wide, while in others it is wider than long; width 11-14% TL. Subanal area also sunken. Spines very short, reaching a maximum length of 5 mm in ambulacrum III aborally. Ophicephalous, tridentate, rostrate, triphyllous and

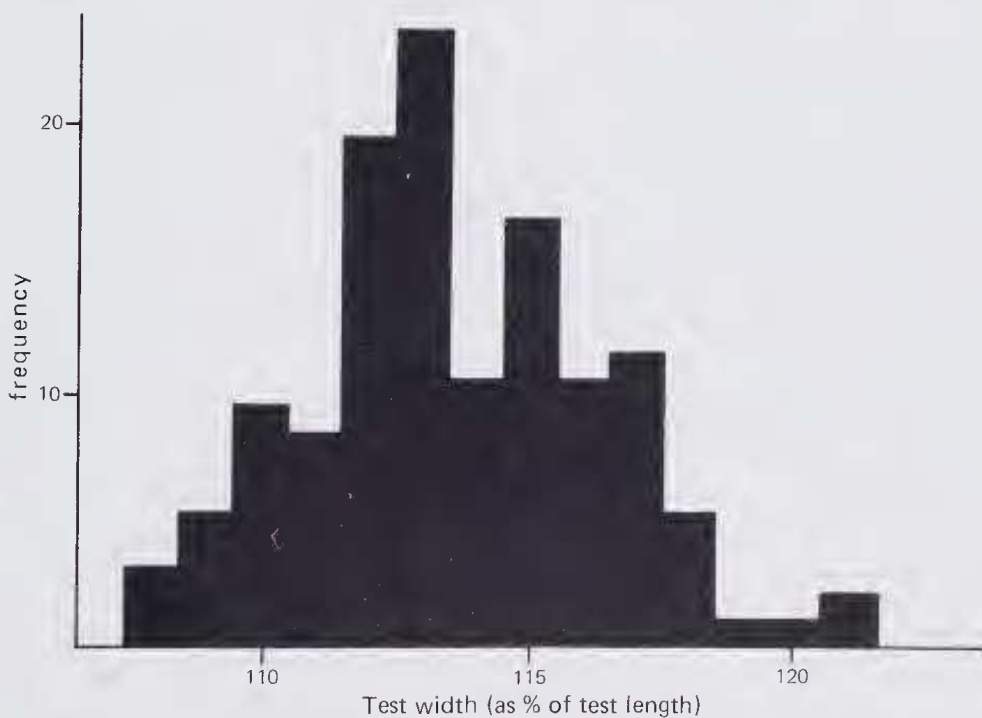
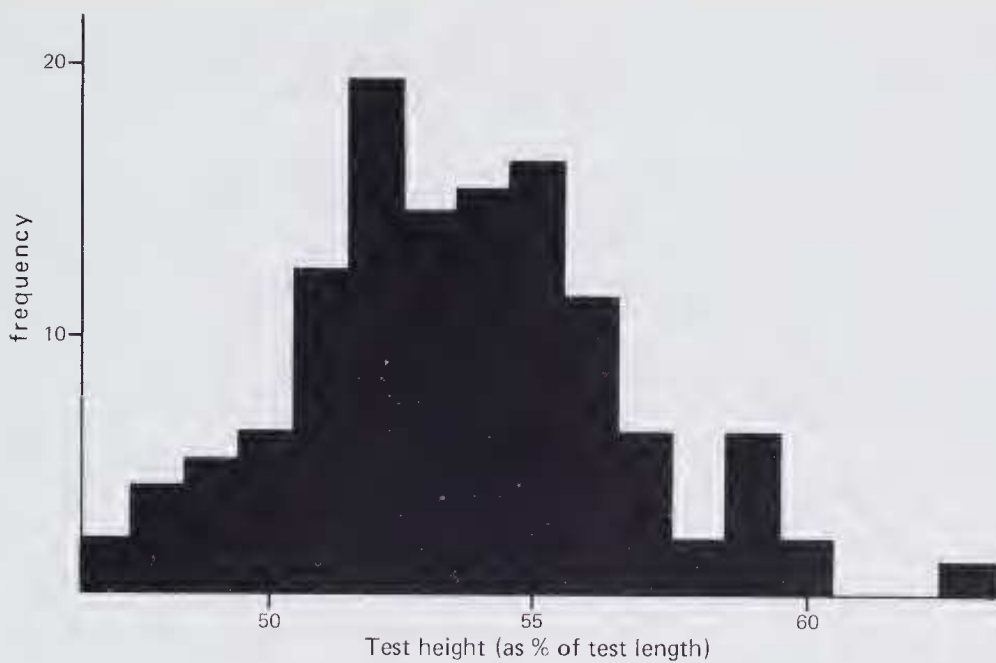


Figure 4 Histograms showing variation of test height and width in *Pericosmus porphyrocardius*.

globiferous pedicellariae present, as in other species of *Pericosmus* (Mortensen 1951: 168). The valves of the ophicephalous pedicellariae are particularly short. These pedicellariae are especially common, over many parts of the test.

Remarks

P. porphyrocardius is a distinctive species totally unlike any other living species of *Pericosmus*. It is morphologically most similar to *P. cordatus*. However it can be distinguished by its possession of a broader, flatter test, which is more posteriorly truncate; longer petals and larger periproct. *P. porphyrocardius* differs from *P. akabanus* and *P. tenuis* in its possession of a broader, flatter test; deeper anterior notch and broader plastron. It can further be distinguished from *P. akabanus* in possessing shorter, narrower petals; less anteriorly projecting labrum;

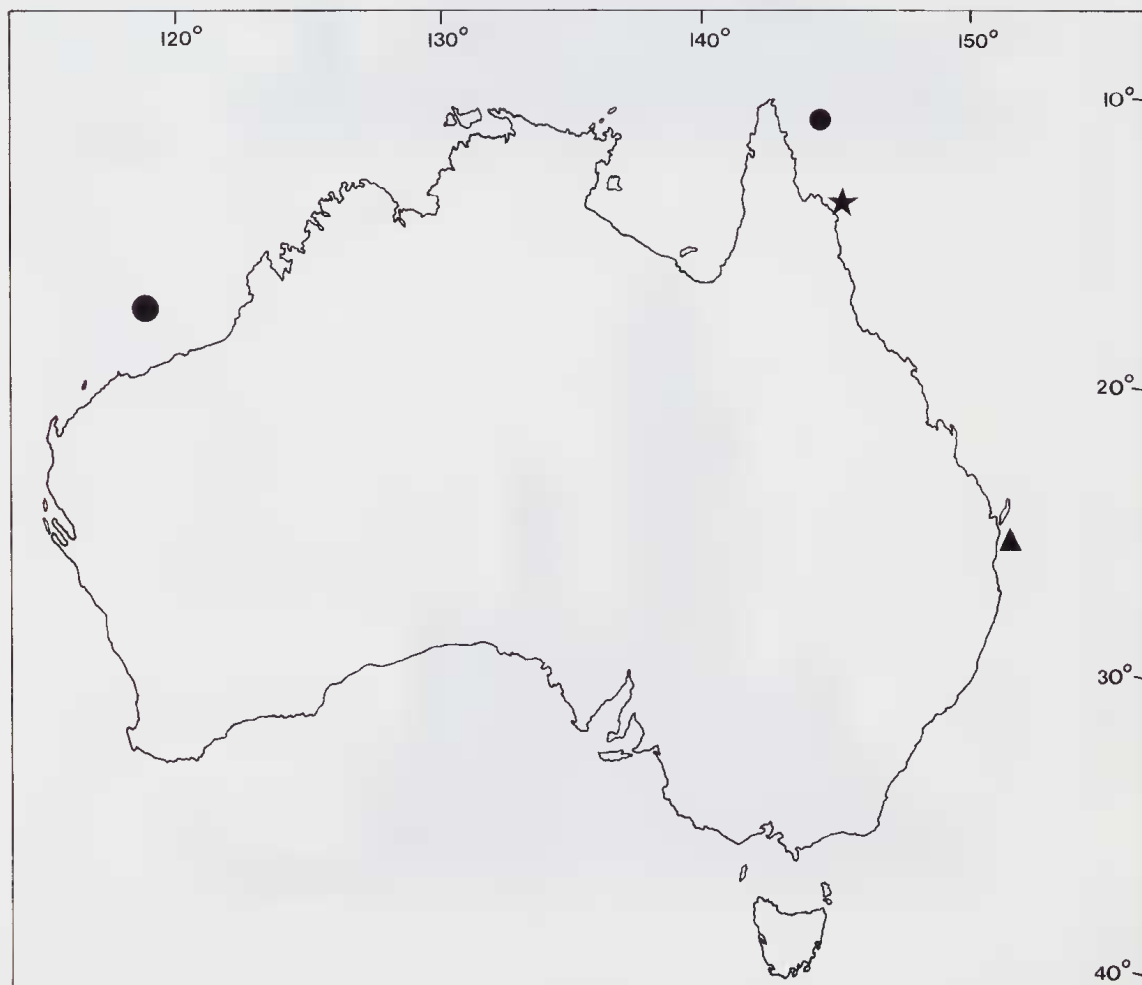


Figure 5 Map showing distribution of the species of *Pericosmus* around Australia; ● = *P. porphyrocardius*; ★ = *Pericosmus* sp. A; ▲ = *Pericosmus* sp. B.

and larger periproct; and from *P. tenuis* in having a more sunken peristome, across which the labrum projects to a greater extent.

McNamara and Philip (in press) in examining fossil species of *Pericosmus* have discussed how it is inappropriate to use the nature of the adoral plating of interambulacrum 1 in the familial placement of *Pericosmus*, a course which had been advocated by Chesher (1968) and Henderson (1975). Examination of the form of the adoral plating in *P. porphyrocardius* reinforces the opinion of McNamara and Philip (in press). The adoral plating of ambulacrum I and interambulacrum 1 shows a high degree of variability in *P. porphyrocardius*. Such intraspecific variability in this character has hitherto not been described in spatangoids. In most specimens the second plate of interambulacrum 1b bisects the plates of interambulacrum 1a to abutt both ambulacra I and II. However, as described above, in some specimens this bisection fails to occur. The size of the adoral plates three and four of ambulacrum Ib is very variable; their expansion greatly affects the size and disposition of the plates in interambulacrum 1. Bisection of the plates in interambulacrum 1a occurs in *P. akabanus* (Mortensen 1951, pl. 15, fig. 6), but not in *P. cordatus* (Mortensen 1951, Pl. 16, figs 6, 7). This variability in the nature of the adoral plating confirms that the use of this character in suprageneric classification in spatangoid echinoids is inadvisable.

Etymology

Porphyra (Gr.): purple; *kardia* (Gr.): heart

Pericosmus sp. A

Figure 6

Pericosmus macronesicus Koehler, 1914; H.L. Clark 1932: 217-218, Plate 1, fig. 4; — H.L. Clark 1946: 363; — Mortensen 1951: 177.

Material

BM1932.1.21.1, from just under 1 km outside Cook's Passage, near Lizard Island, Queensland, 14°31'S, 145°34'E; dredged from 420 m.

Description

Test 60 mm in length; relatively narrow, width 93.8% TL; moderately vaulted, height 62.6% TL; apex at mid test length, posterior of apical system; posterior truncated and inclined adorally. Anterior notch moderately impressed and broad. Apical system situated anterior of centre at 40.3% TL from anterior ambitus; slightly sunken. Ambulacrum III sunken adapically, then shallows slightly abapically before deepening toward ambitus. Anterior paired petals moderately impressed, quite broad; 35.8% TL long; diverge anteriorly at about 115°; each row possesses about 30 pore pairs; pores circular, not conjugate. Posterior paired petals shorter than anterior pair; 28.5% TL; diverge at about 75°; each row

possesses about 25 pore pairs. Peripetalous fasciole slightly indented between posterior petals; more strongly indented between anterior and posterior petals; incomplete anteriorly. Marginal fasciole follows the ambitus.

Adoral surface slightly convex. Peristome moderately sunken; broad, 16.2% TL. Labrum projects slightly anteriorly. Plastron very narrow, 20.3% TL. Nature of second plate of interambulacrum 1b unknown. Periproct slightly sunken, slightly broader than long, width 15.3% TL. Subanal area slightly depressed. Pedicellariae as in other species of *Pericosmus*. Ophicephalous pedicellariae particularly densely distributed over periplastral area.

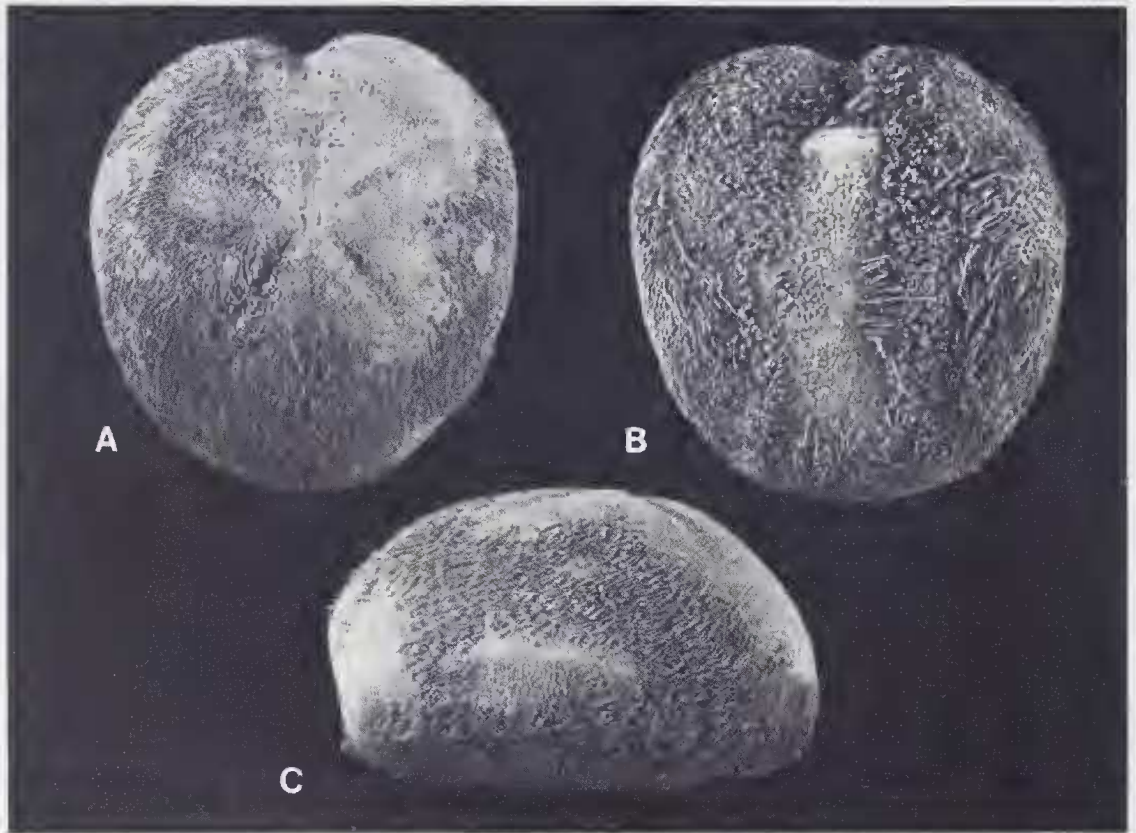


Figure 6 *Pericosmus* sp. A, BM 1932.1.21.1, from just under 1 km outside Cook's Passage, near Lizard Island, Queensland, 16°31'S, 145°34'E. (A) aboral view; (B) adoral view; (C) lateral view; all x 1.

Remarks

Mortensen (1951: 177) expressed doubts over whether this specimen, which H.L. Clark (1932) described, was, as Clark thought, *P. macronesicus*. However, Mortensen gave no reasons for his doubts. Comparison of the specimen with Koehler's (1914, Pl. 7, figs 1-5) type material from the Andaman Islands shows

little similarity between the two. *Pericosmus* sp. A has a narrower, slightly higher test; narrower, shallower petals which are appreciably shorter; slightly broader peristome and periproct; much less anteriorly projecting labrum.

Pericosmus sp. A differs from *P. tenuis*, which was dredged off Mauritius, in possessing a deeper anterior notch; a broader, more sunken peristome; and longer anterior petals. It can be distinguished from *P. akabanus*, a Red Sea species, by its much shorter, narrower petals; slightly lower test; and shorter labrum. *Pericosmus* sp. A is probably most similar to the Goto Island species *P. cordatus*, but it has a shallower anterior notch, slightly higher and narrower test. It differs from the Mauritian species *P. bidens* in possessing longer anterior petals, higher test and more anteriorly situated apical system, and from *P. keiensis* also in having longer anterior petals, but possessing a lower test and deeper anterior notch.

Pericosmus sp. A is quite unlike *P. porphyrocardius*, which also occurs in waters off north-eastern Queensland, in its narrower, more tumid test; its shallower anterior notch; its deeper petals; narrower plastron; and shallower periproct and subanal area.

Pericosmus sp. B

Figures 7 and 8

Material

NMNZ ECH.3426, collected from a depth of about 300 m off the southern Queensland coast at 26°30'S, 153°44'E (Station 53 of the *Nimbus*).

Description

Test 39.0 mm in length; narrow and tumid, width 91.9% TL, height 71.8% TL. Maximum width anterior of centre, in line with position of apical system, which is 42.2% TL from the anterior ambitus. Anterior notch broad and shallow. Ambulacrum III deep adapically, but shallows abapically; pore pairs well developed and closely spaced, pores being separated by a prominently raised interporal partition. Anterior paired petals broad and moderately deep; diverge at about 120°; 34.1% TL; possess 27 pore pairs in each row; pores in posterior row more widely spaced adapically. Posterior paired petals similarly broad and quite deep; diverge at about 70°; short, 26.0% TL; possess 21 pore pairs. Peripetalous fasciole transverse between posterior petals; slightly indented between posterior and anterior petals, crossing plate 7 of 1a and plates 7 and 8 of 1b; bifurcates in interambulacra 1 and 3, two branches crossing ambulacrum III. Marginal fasciole runs around ambitus, crossing plate 4 of lateral interambulacra. Interambulacra swollen adapically, forming keels.

Adoral surface strongly convex. Peristome small, width 12.5%; barely sunken. Labrum does not project anteriorly. Plastron narrow, width 23.2% TL. Second plate of interambulacrum 1b greatly enlarged and bisects first and second plates

of interambulacrum 1a (Figure 8). Periproct small, subcircular, width 11.5% TL. Subanal area hardly sunken.

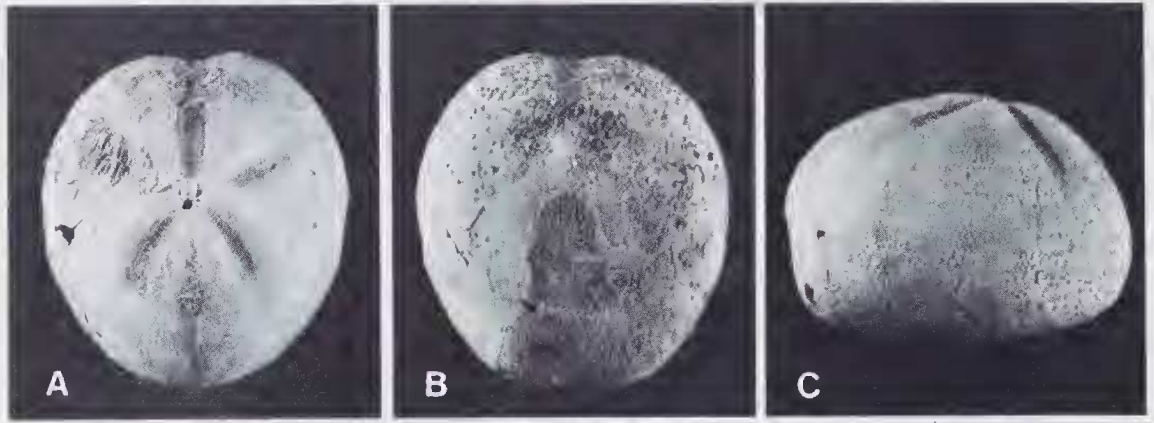


Figure 7 *Pericosmus* sp. B, NMNZ ECH.3426, from off the southern Queensland coast at 26°30'S, 153°44'E. (A) aboral view; (B) adoral view; (C) lateral view; all x 1.

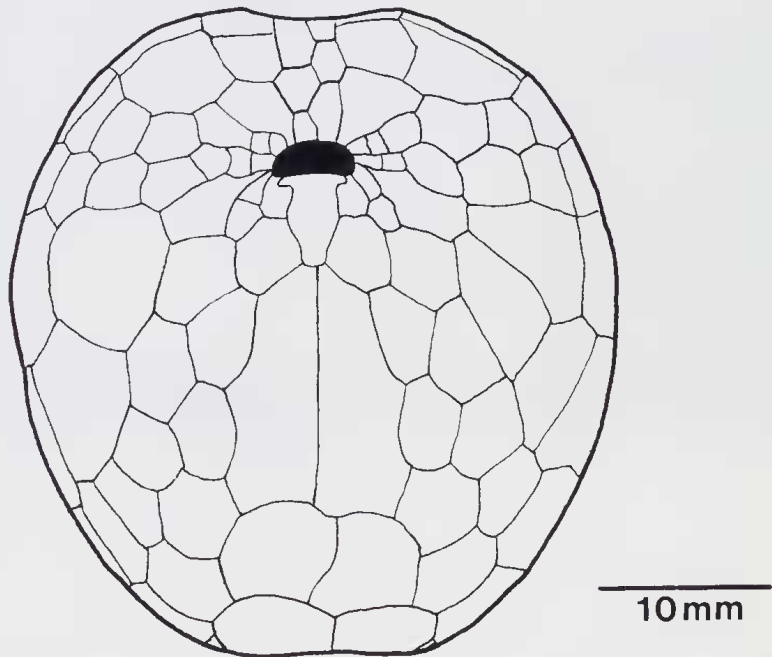


Figure 8 Adoral plating of *Pericosmus* sp. B, NMNZ ECH.3426.

Remarks

Although *Pericosmus* sp. B appears superficially similar to *Pericosmus* sp. A, it possesses a number of significant features which serve to distinguish the two species. The test of *Pericosmus* sp. B is more tumid, the adoral surface in particular being appreciably more convex. Furthermore, *Pericosmus* sp. B possesses a shallower anterior notch; a deeper ambulacrum III adapically; deeper, shorter petals which possess fewer pore pairs; keeled interambulacra adapically; shallower, smaller peristome; shorter labrum; and smaller periproct which is not sunken.

There is little chance of confusing *Pericosmus* sp. B with the other Australian species *P. porphyrocardius*, as they share no features of specific significance in common. *Pericosmus* sp. B differs from *P. tenuis* in possessing sunken petals (they are not sunken at all in *P. tenuis* [Mortensen 1951: 190]); longer, more poriferous petals; tubercles in the interporiferous zone of the petals; and ambulacrum III sunken adapically. The two species possess similar adoral surfaces, although the peristome of *Pericosmus* sp. B is slightly smaller and the surface is a little more strongly convex. *Pericosmus* sp. B can be differentiated from *P. akabanus* on the basis of its much shorter petals; its shallower anterior notch; smaller peristome and periproct; and shorter labrum. It differs from *P. cordatus* in possessing broader petals; shallower anterior notch; more tumid test; and smaller, shallower peristome and periproct.

Pericosmus sp. B compares with *P. keiensis* in possessing a deepened ambulacrum III adapically, and keeled interambulacra adapically. Furthermore, both have a tumid test. However, *Pericosmus* sp. B is distinguished by its more anteriorly situated apical system; its more poriferous, longer anterior petals, which are less divergent; smaller peristome, and posterior of the test which is not vertical, as in *P. keiensis*, but slopes a little adorally.

In addition to having a smaller peristome and more tumid test than either *P. bidens* or *P. macronesicus*, *Pericosmus* sp. B can be distinguished from *P. bidens* by its shallower anterior notch and broader petals, and from *P. macronesicus* by its shorter petals and shorter labrum.

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